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# DEVICE FOR RECHARGING A BELT CONVEYOR AT A CONTACT WITH A BLADE

The present invention concerns a device and a method for electrical charging of a transport belt for the transport of recording media in the transfer printing region of an electrophotographic printer or copier device. The invention also concerns an associated blade-like contact element.

In electrophotographic printers or copier devices, the transfer of a toner image from an intermediate carrier (for example a photoconductor drum or a photoconductor belt) onto a recording medium is designated as transfer printing. The section of the printer or copier device at which the intermediate carrier and the recording medium are brought into contact with one another is designated as a transfer printing region. In the transfer printing region, the intermediate carrier (for example the generated surface of a photoconductor drum) and the recording medium move with the same speed in the same direction while the toner is transferred from the intermediate carrier onto the recording medium.

A good print image on the recording medium can only be achieved when a uniform contact is produced between recording medium and intermediate carrier in the transfer printing region. A good and uniform contact between recording medium and intermediate carrier can be achieved with the aid of an electrostatically-chargeable transport belt on which the recording media lies and, adhering to this with electrostatic forces, is transported through the transfer printing region.

A device for transfer of a toner image with the aid of an electrostatically-chargeable transport belt is shown in DE 102 47 368.4 (not previously published), which is incorporated by reference into the present specification. In this device, the transport belt is charged with a charge whose polarity is different than the polarity of the charge of the toner image. This electrostatic charging of the transport belt has a two-fold function: on the one hand, it effects an electrostatic

attraction of the recording medium to the transport belt and thus a secure guidance of the recording medium in the transfer printing region; on the other hand, it effects the transfer of the toner image from the intermediate carrier onto the recording medium.

Similar devices with electrostatically-charge transport belts are also known from US 5,666,622, DE 195 01 544 A1 and US 5,159,392. In these three documents, the transport belt is either charged via corona arrangements (what are known as corotrons) or via contact rollers. A corotron typically comprises one or more thin, gold-coated tungsten wires whose electrical potential is some 1000 V relative to a grounded housing, such that the air surrounding the wires is ionized.

However, corotrons have a series of serious disadvantages, for example the ozone formation due to the high charge voltage and the relatively complicated exchange of worn-our corotron wires. Moreover, the corotron wires are easily contaminated with dust, belt abrasion particles and toner particles, which leads to an irregular charge distribution on the transport belt. Locations with lower transport belt charge lead to a less complete transfer of the toner onto the overlying recording medium and thus to unwanted print image lightenings. The cleaning of the corotron wires is not only elaborate but also represents a significant mechanical stress for these and shortens their lifespan.

Contact rollers also have the disadvantage that they can contaminate easily and thereby lead to an irregular charge of the transport belt. Moreover, they can not be directly arranged in the transfer printing region because they would interfere with the uniform arrangement of the recording medium on the intermediate carrier. Nevertheless, in order to achieve a sufficient charge of the transport belt in the transfer printing region, a certain current must flow from the contact point from contact roller [sic] and transport belt to the transfer printing region. Therefore the conductivity of the transport belt may not be too low, which represents a disadvantageous limitation for the selection of the transport belt material used.

The invention is based on the object to specify a device and a method for charging of the transport belt that enable a uniform charge of the transport belt in the transfer printing region and requires a lesser maintenance expenditure.

This object is inventively achieved via a device and a method in which a blade-like contact element is arranged transverse to running direction of the transport belt and abutting on this, via which contact element an electrical charge is transferred to the transport belt, and in which the blade-like contact element can be arranged on a carrier element that can be inserted into and extracted from the printer or copier.

Such a blade-like contact element can be arranged directly in the transfer printing region on the side of the transport belt facing away from the intermediate carrier, and therewith provides for a reliable, uniform charge of the transport belt in the transfer printing region. Since the transport belt continually drags along on the blade-like contact element, this is constantly cleaned. Due to the removal capability of the carrier element, the Blade-like [sic] contact element is easily accessible for maintenance tasks. The Blade-like [sic] contact element is preferably fastened on the carrier element such that it can be detached, such that it can be easily exchanged as an expendable part. Advantageous developments of the invention are specified in the further claims.

For better understanding of the present invention, reference is made in the following to the preferred exemplary embodiment shown in the drawings which is described using specific terminology. However, it is noted that the protective scope of the invention should not thereby be limited since such variations and further modifications to the shown device and the method as well as such further applications of the invention as they are shown therein are viewed as typical present or future specialized knowledge of a competent average man skilled in the art.

Figures show an exemplary embodiment of the invention, namely

Figure 1 a schematic representation of the components of an electrophotographic printer or copier participating in the image generation;

Figure 2 a perspective representation of a paper transport aggregate for a printer or copier in which the carrier element for the blade-like carrier element is extracted;

Figure 3 a perspective representation of the paper transport aggregate from Figure 2, in which the carrier element is inserted;

Figure 4 a perspective representation of the carrier element and of the blade-like contact element; and

Figure 5 a perspective representation of the carrier element and of the blade-like contact element from Figure 4 from another viewing direction.

The components of an electrophotographic printer that participate in the image generation are schematically shown in Figure 1. Figure 1 shows a photoconductor drum 10 whose peripheral surface is coated with a photosemiconductor, for example arsenic triselenide ($As_2Se_3$). Also shown in Figure 1 is [sic] a charge corotron 12 for charging of the photosemiconductor layer of the photoconductor drum 10, a character generator 14 for exposure of the photosemiconductor layer in order to generate a latent charge image on said photosemiconductor layer, and a developing unit 16 to develop the latent charge image with charged toner particles.

A paper transport aggregate 18 is also schematically shown in Figure 1 by a dashed box. The paper transport aggregate 18 comprises a transport belt 20 that is directed around a first roller 22, a second roller 24, a tension roller 26 and a positioning

roller 28. The transport belt 20 is driven by the first roller 22 in the direction characterized by the arrow 30. The paper transport aggregate 18 also comprises a device 32 for electrical charging of the transport belt 20 that is only schematically shown in Figure 1. The device 32 comprises a blade-like contact element 34 that is arranged transverse to the running direction of the transport belt 20 and abutting on this. Finally, the paper transport aggregate 18 comprises a cleaning unit 36 with an abrasion ridge 28 for abrasion of toner particles from the transport belt 20 and a toner capture reservoir 40 for capture of the abraded toner.

Finally, a cleaning unit 42 for cleaning of the photoconductor drum and a fixing unit 44 for fixing the toner image toner [sic] onto the paper are shown in Figure 1. More detailed explanations of the function of the listed elements from Figure 1 are found in DE 102 47 368.4 (cited above, not previously published) and should not be repeated here.

The transport belt 20 serves for the transport of a sheet paper [sic] 46 (likewise shown in Figure 1) through the transfer printing region 48 in which the sheet paper [sic] 46 is pressed against the photoconductor drum 10. The transport belt 20 is charged by the device 32 with a charge that is opposite the charge of the toner particles. The electrostatic charge of the transport belt 20 provides for a secure retention of the sheet 46 on the transport belt and for transfer of the toner particles from the photoconductor drum 10 onto the sheet 46.

As is to be learned from the schematic representation of Figure 1, in the transfer printing region the blade-like contact wavelength 34 of the transport belt 20 contacts on the side facing away from the photoconductor drum 10 (the underside in the representation of Figure 1). This means that the electrical charge there is precisely transferred to the transport belt 20 at which it is required. Upon transfer of the toner from the photoconductor drum 10 onto the sheet 46, an electrical current flows from the transport belt 20 to the photoconductor drum 10. Since the contact blade 34 is arranged in the transfer printing region, this current does not

have to flow in the longitudinal direction of the transport belt 20 to the transfer printing region 48.

The paper transport aggregate 18, which was shown only schematically in Figure 1, is shown in a perspective representation in Figure 2. One recognizes the transport belt 20, the first roller 22 (or, respectively, its axle), the second roller 24, the tension roller 26 (or, respectively, its axle), the positioning roller 28 and the toner capture reservoir 40 described in connection with Figure 1. The device 32 for electrical charging of the transport belt 20 is also shown. The device 32 comprises a carrier element 48 made of plastic, to which carrier element 48 the blade-like contact element 34 is attached.

The paper transport aggregate 18 has a recess 50 into which the carrier element 48, with its attached contact element 34, can be inserted. The paper transport aggregate 18 with inserted carrier elements [sic] 48 is shown in Figure 3.

As is to be learned from Figures 2 and 3, the carrier element 48 has an engagement section 52 at which it can be gripped upon insertion into or, respectively, upon extraction from the paper transport aggregate 18. A detent hook 54 (see Figure 2) is integrated into the engagement section 52, which detent hook 54 is pre-stressed in a blocking position in which it engages in a matching groove 55 in the recess 50 when the carrier element 48 is completely inserted into the paper transport aggregate 18. The detent hook 54 can be raised from its blocking position via activation of a release button counter to the pre-stress such that the carrier elements [sic] 48 can be extracted from the paper transport aggregate 18.

A first plug element 58 (Fig. 2, Fig. 3) is located on the end of the carrier element 48 opposite the engagement section 52. A second plugg [sic] element (not shown) is located in the printer, with which second plug element the first plug element forms an electrical plug connection when the carrier element 48 is completely

inserted into the paper transport aggregate 18 (and this is, for its part, inserted into the printer).

The carrier element 48 and the blade-like contact element 34 are shown in an unassembled state in Figure 4. The blade-like contact element comprises an angle plate with a first section 60 and a second section 62 that, in the shown exemplary embodiment, form with one another an angle of approximately 90°. The second section 62 of the Blade-like [sic] contact element 34 has two recurved sections 64. A rectangular gap 66 in the second section 62 is located between the recurved sections 64.

A film 68 made from polyimide is adhered with a conductive adhesive onto the first section 60 of the angle plate. The film 68 has a thickness of 75 µm. Via interspersed carbon black particles, its volume resistance is reduced to a value that is between $10^2$ and $10^9$ Ωcm, preferably between $10^6$ and $10^8$ Ωcm. Its surface resistance is between $10^2$ and $10^{12}$ Ω/sq, preferably between $10^{10}$ and $10^{12}$ Ω/sq.

The carrier element 48 has an essentially V-shaped cross section that is formed from a floor area 70 and a back wall 72. Small blocks 74 are arranged on the floor area 70 that are separated from the back wall 72 and with this respectively form a groove 76. Such a groove 76 can be recognized particularly well in Figure 5, in which the carrier element 48 and the blade-like contact element 34 are shown from a different viewing angle. Pressure pins 78 that are pre-stressed against the back wall 72 are spring-borne in the small blocks 74. Finally, a web 80 that, together with the back wall 72, forms a further groove 82 is arranged on the floor area 70.

The groove 82 and the three grooves 76 form a recess into which the second section 62 of the blade-like contact element 34 can be inserted with positive fit. Both outer pressure pins 78 thereby press on the second section 62 of the blade-like contact element 34 and hold this in position. The center pressure pin 78 has a rounded tip and engages in the gap 66 in the second section 62 of the blade-like

contact element 34, whereby it exerts pressure on the lower edge of the gap 66 in the representation of Figure 4 and thereby exerts a force component on the blade-like contact element 34 that pushes this into the recess.

A notch 84 is located in the web 80, into which notch 84 a guide section 86 on the blade-like contact element 34 engages when it is inserted into the recess of the carrier element 48. The guide section 86 and the notch 84 thereby help to find the correct position upon insertion of the blade-like contact element 34 into the recess of the carrier element 48.

Upon insertion of the blade-like contact element 34 into or, respectively, upon extraction of the same from the recess of the carrier element 48, the blade-like contact element can be gripped at the recurved sections 64. The blade-like contact element 34 is an expendable part and can be easily exchanged in the manner specified here and without the assistance of tool [sic]. In particular the exchange of the Blade-like [sic] contact element is made easier in that the carrier element can simply be extracted from and inserted back into the printer or copier (in the shown exemplary embodiment from the paper transport aggregate 18 of such a one).

Electrical contacts (not shown) that contact the second section 62 of the angle plate when this is inserted into the recess of the carrier plate 48 are located in the groove 82. A current flow from the plug element 58 over the angle plate and the film 68 onto the transport belt is ensured via these contacts.

Although a preferred exemplary embodiment is shown and described in detail in the drawings and in the preceding specification, this should be viewed as purely exemplary and not as limiting the invention. It is noted that only the preferred exemplary embodiment is shown and described, and all variations and further modifications that presently and in the future lie within the protective scope of the invention should be protected.

Reference list

| | |
|---|---|
| 10 | Photoconductor drum |
| 12 | charge corotron |
| 14 | character generator |
| 16 | developing unit |
| 18 | paper transport aggregate |
| 20 | transport belt |
| 22 | first roller |
| 24 | second roller |
| 26 | tension roller |
| 28 | position roller |
| 30 | rotation direction of the first roller |
| 32 | device for electrical charging of the transport belt 20 |
| 34 | blade-like contact element |
| 38 | abrasion ridge |
| 40 | toner capture reservoir |
| 42 | cleaning unit |
| 44 | fixer unit |
| 46 | paper sheet |
| 48 | carrier element |
| 50 | recess |
| 52 | engagement section |
| 54 | detent hook |
| 55 | groove |
| 56 | release button |
| 58 | first plug element |
| 60 | first section of the angle plate |
| 62 | second section of the angle plate |
| 64 | recurved section |
| 66 | gap |

| | | |
|---|---|---|
| | 68 | plastic film |
| | 70 | floor area |
| | 72 | back wall |
| | 74 | small block |
| 5 | 76 | groove |
| | 78 | pressure pin |
| | 80 | web |
| | 82 | groove |
| | 84 | notch |
| 10 | 86 | guide section |